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(56) Documents Cited

GB 2221428 A GB 1576441 A GB 0686902 A

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PC26 PC27 PC29 P1A27, F4S

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F16L 58/00 58/02 58/08

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(54) Anti-fouling Coatings

(57) An anti-fouling coating material for application to elastomer coated articles comprises a sheet of antifouling material 10 having a plurality of elongate slots 12 formed therein. The slots are arranged in columns, and are dimensioned and arranged to permit the material to deform so as to accommodate thermal expansion and contraction of the elastomer material, particularly in the process of curing of the elastomer coating after application of the material thereto. The coating material may include an elastomer layer 28 on the side thereof which is to be applied to the elastomer coated article. The slots 12 are preferably arranged in vertically staggered columns, with V-shaped, interleaving ends. The material may be formed as an elongate strip for application to a tubular structure 34 by helical wrapping, with the slots extending across the width of the strip.

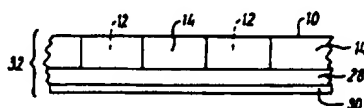


Fig. 3

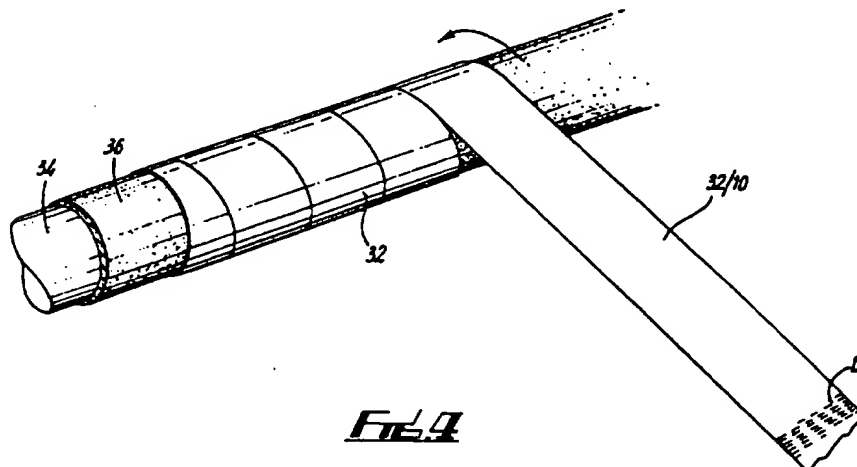


Fig. 4

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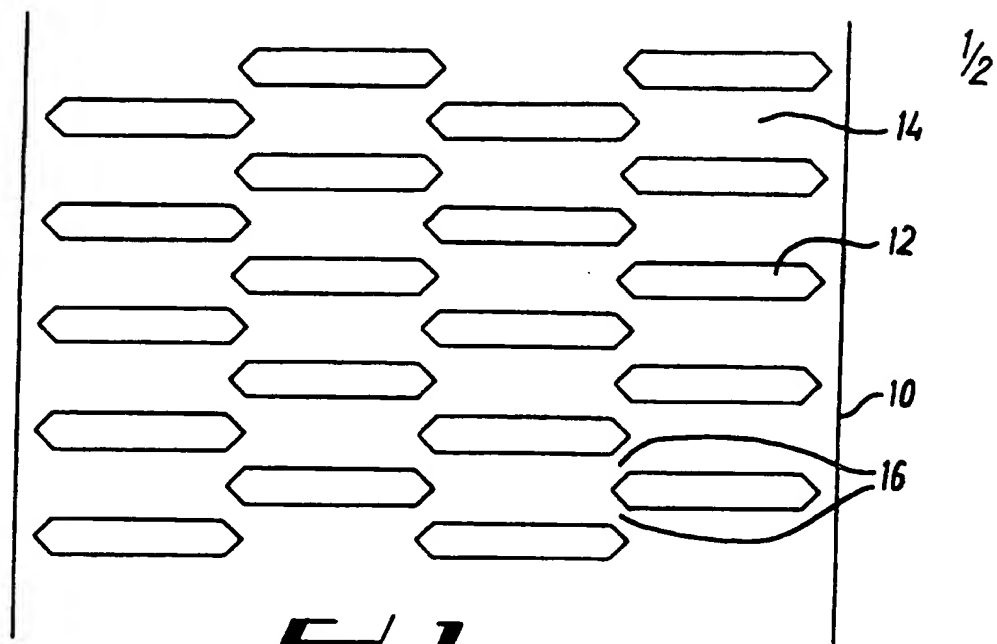


FIG. 1

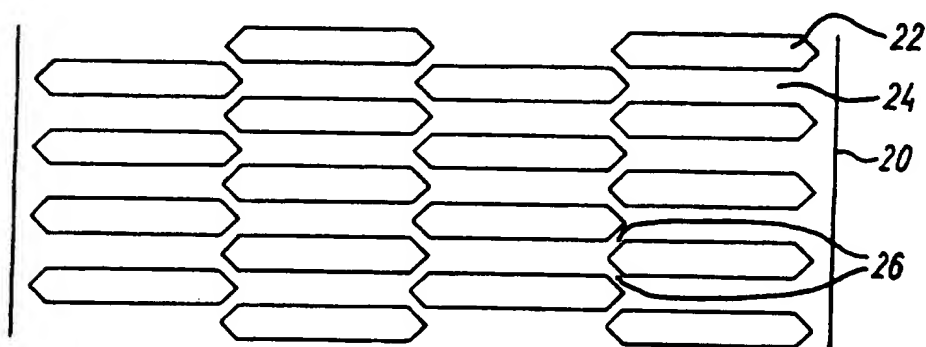


FIG. 2

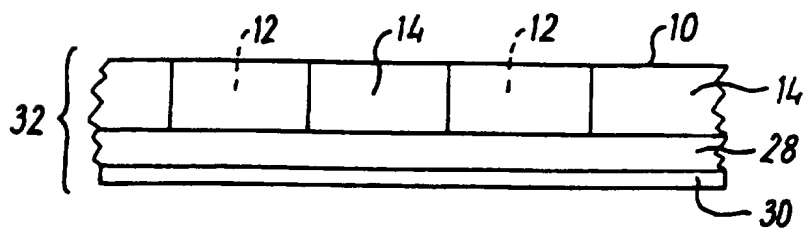


FIG. 3

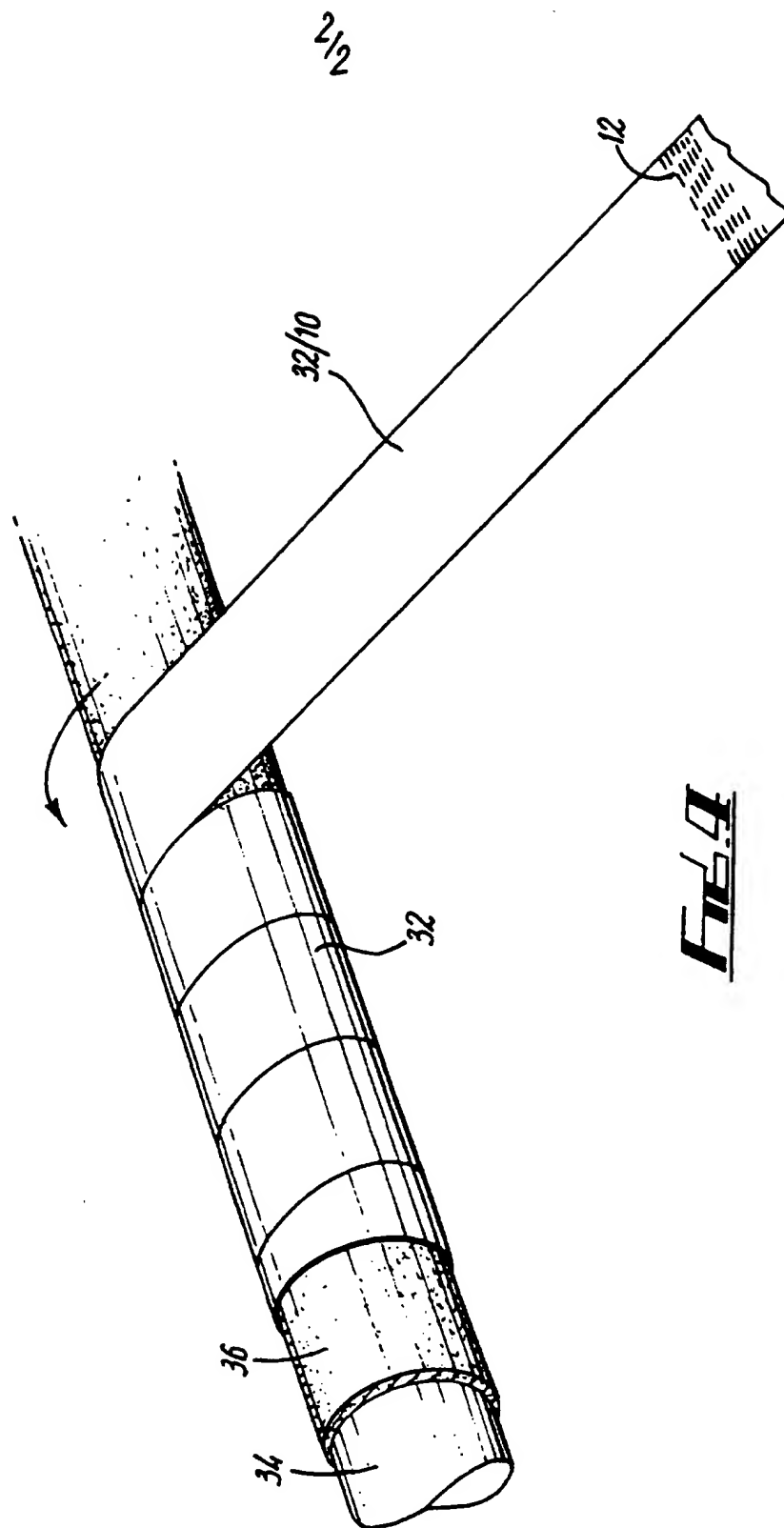


FIG. 1

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1 "Improvements in or Relating to Anti-Fouling Coatings"

2

3 This invention relates generally to coatings or
4 coverings for protecting subsea structures,
5 (particularly but not exclusively tubular structures
6 such as risers, conductors and caissons) from fouling
7 by marine organisms, and to processes for applying the
8 coating or covering.

9

10 Marine fouling of offshore structures and their
11 appurtenances by marine organisms, especially mussels,
12 is extremely troublesome and incurs high costs. The
13 major growth of mussels occurs from L.A.T. down to
14 minus 100 ft. Growth rates vary dependent upon water
15 temperature, tides and prevailing weather conditions.
16 In ideal conditions mussel build up can be as high as
17 200 mm in a growing season.

18

19 Offshore operators require to increase the amount of
20 steel required to construct an offshore structure to
21 compensate for the additional weight (many tons) of
22 accumulated marine organisms, but more importantly to
23 compensate for additional wave loadings due to the
24 increased dimensions of affected members.

25

1 It has been a known fact for many years that copper, or
2 copper nickel with a high percentage of copper, emits
3 copper ions when in a submerged condition, which in
4 turn prevents adherence of marine life to the copper
5 surface.

6
7 Copper or copper nickel sheet must not be allowed to
8 come into contact with the steel it is protecting,
9 otherwise a galvanic action occurs accelerating
10 corrosion and also making the copper ineffective as an
11 anti-fouling material (a switching off effect).

12
13 Many of the appurtenances of offshore structures as
14 well as some of the main structures are normally
15 protected from corrosion by elastomer coatings
16 vulcanised and bonded to the steel surfaces. The
17 elastomer coatings are normally factory applied to
18 steel members before the platform is constructed. The
19 elastomer coating provides an ideal electrical
20 insulation between the steel and the anti-fouling
21 material.

22
23 Many attempts in the past have been made to provide a
24 technically acceptable and cost effective method of
25 applying copper or copper nickel to tubular steel.
26 Systems which have been used in the past are:-

- 27
- 28 a) Forming two half shells of copper nickel which are
29 prepared and applied to the uncured elastomer coat
30 and bonded in position.
 - 31
 - 32 b) Supporting copper nickel wire mesh or copper
33 nickel granules in a matrix of elastomer or epoxy
34 which is then applied in sheet form to the
35 anti-corrosion coat on the tubular member.

1 c) Producing the copper nickel sheet in strip form
2 approximately 150 mm wide in which a corrugation
3 effect or a regular depression has been formed,
4 which is then prepared and helically wrapped
5 around the elastomer coat.

6
7 The coated pipe is placed into a steam autoclave where
8 the temperature crosslinks the elastomer and forms a
9 bond between the elastomer and steel and between the
10 elastomer and copper nickel.

11
12 System a) is very labour intensive as only short
13 lengths of half shells can be applied at one time and
14 require precise positioning to leave the longitudinal
15 gaps between the half shells necessary to accommodate
16 differential thermal expansion between the shells and
17 the elastomers.

18
19 System b) is not cost effective as major manufacturing
20 costs are involved in producing the wire mesh or
21 granules in a rubber or epoxy matrix. A further
22 disadvantage is that only approximately 35% of the
23 surface area has an exposure of copper nickel.

24
25 System c) provides an effective anti-fouling coating
26 but requires a substantial thickness of elastomer
27 beneath the corrugation or concave deformation of the
28 copper nickel to prevent the copper nickel contacting
29 the steel. Any variance from a smooth cylindrical form
30 increases the C.D. (drag coefficient), lift and vortex
31 shedding of the tubular member, and increases the
32 forces generated by water velocity.

33
34 It has been generally accepted that it is not possible
35 to successfully apply copper nickel sheet in strip form

1 and in a helical wrap fashion due to the substantial
2 variation in expansion and contraction between copper
3 nickel and elastomer. During the vulcanisation process
4 the elastomer goes into a flow condition before
5 crosslinking. On cooling down after vulcanisation the
6 elastomer coating contracts to approximately 80% of its
7 original applied thickness. High forces are exerted
8 between the elastomers and copper nickel resulting in
9 either a break in the bond or a buckling effect of the
10 copper nickel cladding.

11
12 System c) as previously described overcomes this
13 problem due to the bellows effect of the deformations
14 in the copper nickel allowing to some degree the copper
15 nickel to contract mechanically from its original
16 circumference, but with the stated disadvantages.

17
18 International Patent Publication No. WO 93/14970
19 describes methods and materials whereby an anti-fouling
20 coating may be applied as a wound strip of sheet
21 material. The strip is formed from a series of panels,
22 the adjacent edges of the panels being spaced from one
23 another to accommodate expansion and contraction of the
24 elastomer coating on top of which the strip is wound.
25 The panels of the strip are connected together at the
26 required spacing by means of strips of material secured
27 to the panels by means of adhesives, the connector
28 strips being removed after the panels have been secured
29 to the elastomer coating. However, difficulties have
30 been encountered in obtaining consistent results with
31 the cupro-nickel adhesive.

32
33 It is an object of the present invention to provide
34 improved materials and methods for applying metallic
35 anti-fouling coatings to structures, particularly

1 tubular structures, which obviate or mitigate the
2 abovementioned disadvantages of previous coating
3 systems.

4
5 In accordance with a first aspect of the invention
6 there is provided a metallic, anti-fouling, coating
7 material adapted to be applied to an elastomer-coated
8 article to be protected, said material comprising a
9 generally planar sheet of anti-fouling material having
10 a plurality of elongate slots formed therein.

11
12 Preferably, said slots are arranged substantially
13 parallel to one another and are arranged in columns.
14 Most preferably, adjacent columns are vertically
15 staggered relative to one another. The slots are
16 dimensioned and arranged such that the material can
17 deform so as to expand and contract in at least one
18 direction to accommodate thermal expansion and
19 contraction of an underlying elastomer coating to which
20 the material is secured, in use. The dimensions and
21 arrangement of the slots are thus determined by the
22 differential thermal expansion and contraction
23 characteristics of the anti-fouling material and the
24 elastomer coating.

25
26 Preferably also, said slots have six sides, having
27 generally V-shaped ends. Most preferably, the slots are
28 arranged in vertically staggered columns, the V-shaped
29 ends of the slots of one column being interleaved with
30 the V-shaped ends of the slots of adjacent columns.

31
32 Most preferably, the material comprises an elongate
33 strip adapted to be helically wrapped about the length
34 of a tubular article. The elongate slots preferably
35 extend across the width of the strip, allowing the

1 strip to deform longitudinally with expansion and
2 contraction of the underlying elastomer coating.

3

4 Preferably, the slots occupy 50% or less of the total
5 surface area of the material. Preferably, also, the
6 slots occupy at least 25% of the total surface area of
7 the material.

8

9 Preferably, the sheet of anti-fouling material has a
10 thickness in the range 0.5 mm to 2 mm.

11

12 In certain embodiments, the sheet of anti-fouling
13 material may have a layer of elastomer material applied
14 to one surface of said sheet. Preferably, such
15 elastomer material has a thickness less than or equal
16 to that of the sheet of anti-fouling material, most
17 preferably in the range 0.5 mm to 1 mm.

18

19 Preferably, the length of the slots is in the range 3
20 mm to 50 mm. Preferably also, the width of the slots is
21 in the range 1 mm to 6 mm.

22

23 In accordance with a second aspect of the invention,
24 there is provided a structure having an elastomer
25 coating applied to the surface thereof and a metallic
26 anti-fouling coating in accordance with the first
27 aspect of the invention applied to the surface of the
28 anti-corrosion coating.

29

30 Preferably, said structure is a tubular structure and
31 said anti-fouling material is in the form of an
32 elongate strip helically wrapped about and along the
33 tubular structure.

34

35 In accordance with still a further aspect of the

1 invention, a method of forming a structure in
2 accordance with the second aspect of the invention
3 comprises the steps of applying an elastomer coating to
4 said structure, applying anti-fouling material in
5 accordance with the first aspect of the invention to
6 said tubular member on top of said elastomer coating so
7 as to cover substantially all of the coated surface of
8 the structure, and processing the resulting assembly to
9 cure said elastomer coating and/or the elastomer layer
10 of said anti-fouling material (if present) so as to
11 bond said anti-fouling material to said coating.

12

13 It is preferred either that the elastomer coating is
14 uncured or at least partially cured prior to
15 application of the anti-fouling material to the
16 structure. Where used, it is preferred that said
17 elastomer layer is uncured or partially cured prior to
18 the application of the anti-fouling material to the
19 structure.

20

21 Preferably, a pressure strip is wrapped on top of the
22 anti-fouling material prior to final curing of the
23 assembly. Where the elastomer layer is omitted, a strip
24 of material, such as nylon, is wrapped on top of the
25 anti-fouling coating prior to the application of said
26 pressure strip, so as to inhibit extrusion of elastomer
27 through the slots in the anti-fouling material.

28

29 Preferably, the structure is a tubular structure and
30 said anti-fouling material is an elongate strip applied
31 to the structure by helically winding said strip about
32 and along the tubular structure.

33

34 Embodiments of the invention will now be described, by
35 way of example only, with reference to the accompanying

1 drawings in which:-

2

3 Fig. 1 is a plan view of a first example of
4 slotted cupro-nickel anti-fouling material in
5 accordance with the present invention;

6 Fig. 2 is a plan view of a second example of
7 slotted cupro-nickel anti-fouling material in
8 accordance with the present invention;

9 Fig. 3 is a side view of anti-fouling material
10 including a layer of cupro-nickel material as
11 shown in Fig. 1 or Fig. 2, a layer of elastomer
12 and a release sheet; and

13 Fig. 4 is a perspective view of an
14 elastomer-coated subsea tubular having applied
15 thereon an anti-fouling covering in accordance
16 with the present invention.

17

18 Referring now to the drawings, Fig. 1 shows a first
19 example of a strip 10 of anti-fouling material, usually
20 of copper or copper alloy such as cupro-nickel, which
21 forms the basis of the present invention.

22

23 The strip 10 is formed with a plurality of
24 substantially parallel, elongate slots 12 having their
25 longitudinal axes extending across the width of the
26 strip 10. The slots 12 are formed in a number of
27 columns, each of which extends along the length of the
28 strip 10, with adjacent columns being staggered
29 relative to one another so that the ends of each slot
30 12 extend slightly between the vertically adjacent
31 slots 12 of the horizontally adjacent columns. The
32 slots 12 are preferably six-sided, with V-shaped ends
33 as shown. It will be understood that Fig. 1 is
34 schematic in nature for the purpose of clearly
35 illustrating the arrangement of the slots 12. The

1 dimensions of the slots relative to the width of the
2 strip, and the number of columns of slots 12, may vary
3 from the illustrated example.

4
5 It can be seen that the slots 12 divide the material of
6 the strip 10 into a number of horizontal portions 14
7 between each pair of vertically adjacent slots 12 in
8 each column, interconnected by relatively narrower
9 diagonal arms 16. This arrangement allows the strip 10
10 to deform along its longitudinal axis, so as to
11 accommodate differential expansion or contraction
12 between the strip 10 and the elastomer coating of a
13 pipe or the like upon which the strip is wound, without
14 buckling which would occur with a solid sheet of
15 material. Such differential expansion or contraction
16 may occur during curing of the elastomer coating or
17 subsequently during use of the coated article.

18
19 In the example of Fig. 1, the vertical spacing between
20 vertically adjacent slots 12 is twice the width of the
21 slots 12 themselves. Accordingly, the slots occupy
22 approximately one third of the total area of the strip
23 10. The proportion of the area occupied by the slots
24 may be varied by varying the arrangement and/or spacing
25 of the slots. Fig. 2 shows a second example of a strip
26 20 in which the width of the slots 22 is equal to their
27 vertical spacing, so that the slots 22 occupy
28 approximately half of the total area of the strip 20.
29 The horizontal portions 24 and diagonal arms 26 of the
30 strip 20 are correspondingly narrower than those of
31 Fig. 1.

32
33 The slots 12, 22 of Figs. 1 and 2 are dimensioned and
34 arranged such that the material can deform so as to
35 expand and contract in at least one direction to

1 accommodate thermal expansion and contraction of an
2 underlying elastomer coating to which the material is
3 secured, in use. The dimensions and arrangement of the
4 slots are thus determined by the differential thermal
5 expansion and contraction characteristics of the
6 anti-fouling material and the elastomer coating.

7
8 For the purposes of the present invention, it is
9 preferred that the strip 10 or 20 be 0.5 mm to 2 mm in
10 thickness and the slots 12 or 22 range in size from 3mm
11 long by 1 mm wide to 50 mm long by 6 mm wide. The width
12 of the strip 10 or 20 may vary as required. The size
13 and spacing of the slots is preferably selected such
14 that the slots occupy 25% to 50% of the strip area,
15 providing exposure of the strip material in the range
16 75% to 50%. This compares advantageously with exposure
17 typically of 37% or less with existing systems such as
18 that discussed at (c) above. The size and spacing of
19 the slots and the thickness of the strip also affects
20 the flexibility of the strip and its ability to expand
21 or contract longitudinally. Accordingly, these
22 parameters may be varied to provide the required degree
23 of flexibility in particular applications of the
24 invention.

25
26 If a metal strip as shown in Figs. 1 and 2 were applied
27 directly to a layer of uncured elastomer on a pipe or
28 the like, then subsequent curing of the elastomer would
29 result in elastomer extruding through the slots when it
30 goes into a flow condition and expands during the
31 autoclaving cycle. The elastomer would thus cover the
32 metal wholly or partially and thereby eliminate or
33 substantially reduce its anti-fouling properties.

34
35 This may be prevented by wrapping a sheet material on

1 top of the anti-fouling coating prior to final curing
2 of a coated article, as shall be discussed further
3 below. Alternatively, a thin layer of uncured elastomer
4 may be applied to one side of the strip prior to the
5 strip being applied to the article to be protected. In
6 one method of applying the invention, the elastomer
7 coating on the article is at least partially cured and
8 the elastomer layer of the strip remains uncured before
9 application of the side of the strip carrying the thin
10 elastomer layer to the coated structure. The thinness
11 of the layer of uncured elastomer is such that it does
12 not extrude over the outer surface of the strip during
13 subsequent curing. In an alternative method, the
14 elastomer coating of the structure is uncured or
15 partially cured and the elastomer layer of the strip is
16 partially cured before the application of the anti-
17 fouling material to the structure.

18
19 Fig. 3 shows a side view of a strip 10 with a thin
20 layer of uncured elastomer 28 applied to one side
21 thereof. Before application of the layer 28, the
22 surface of the strip 10, and particularly the edges
23 thereof, is cleaned and lightly abraded, suitably by
24 blast cleaning using aluminium oxide, at low pressure
25 to avoid distortion of the metal. A suitable primer and
26 elastomer bonding agent is applied by roller, spray or
27 brush, and the elastomer layer 28 is applied thereto
28 and pressed into place by means of a roller or the
29 like. A release sheet 30 of paper, polyethylene or the
30 like is applied to the outer surface of the layer 28,
31 allowing the coated strip to be rolled onto a reel or
32 the like prior to application to the article which is
33 to be protected. It is preferred that the layer 28 be
34 0.5 mm to 1 mm in thickness, less than or equal to the
35 thickness of the metal strip 10. The composite strip

1 comprising the metal strip 10 and elastomer layer 28 is
2 designated by the numeral 32.

3
4 Fig. 4 shows the preferred method of applying the strip
5 10 or composite strip 32 to a pipe 34. The slots 12 on
6 the strip 10/32 are indicated, and it will be
7 understood that these are provided over substantially
8 the entire surface area of the strip. The pipe 34 is
9 first coated with anti-corrosion and/or thermal
10 insulation materials as required, by any suitable
11 method, as is well known in the art. In this example,
12 an elastomer coating 36, typically 6 mm to 12 mm in
13 thickness, is shown. After the coating 36 has been at
14 least partially cured, the strip 10/32 is wound onto
15 the coated pipe 34, under tension, in helical fashion
16 while the pipe 34 is rotated about its longitudinal
17 axis.

18
19 In the case of the composite strip 32, the release
20 sheet 30 is removed as the strip 32 is wrapped. A nylon
21 pressure tape (not shown) is then helically wrapped
22 under tension on top of the strip 32, as is known in
23 the art, before autoclaving to cure the elastomer layer
24 28 and bond the strip 32 to the elastomer coating 36.
25 Alternatively, as noted above, the coating 36 can
26 remain uncured or partially cured prior to wrapping of
27 the strip 32, and the elastomer layer 28 of the strip
28 32 partially cured prior to wrapping.

29
30 Because the elastomer layer 28 of the strip is no
31 thicker than the metallic strip 10, it should not
32 extrude any further than the outer surface of the strip
33 10 after final curing. The slots 12 allow the strip 10
34 to deform along its length with expansion and
35 contraction of the elastomer coating 36 during the

1 curing process, and to accommodate differential thermal
2 expansion and contraction between the coating 36 and
3 the strip 10 in subsequent use of the pipe.

4
5 In the case where the strip 10 is applied without an
6 elastomer backing layer, a strip of nylon material is
7 wound on top of the strip 10 prior to application of
8 the pressure tape. This nylon strip serves to prevent
9 extrusion of elastomer through the slots 12 during
10 final curing. It is preferably the same width as the
11 anti-fouling strip 10, and may be wrapped
12 simultaneously therewith. In this case the elastomer
13 coating 36 is preferably uncured or partially cured
14 prior to application of the strip 10.

15
16 The invention thus provides improved anti-fouling
17 coating materials, improved coated structures employing
18 such materials, and improved methods of applying such
19 materials to structures.

20
21 Improvements and modifications may be incorporated
22 without departing from the scope of the invention.

23
24

1 Claims

2

3 1. A metallic, anti-fouling, coating material adapted
4 to be applied to an elastomer-coated article to be
5 protected, said material comprising a generally planar
6 sheet of anti-fouling material having a plurality of
7 elongate slots formed therein.

8

9 2. A coating material as claimed in Claim 1, wherein
10 said slots are arranged substantially parallel to one
11 another and are arranged in columns.

12

13 3. A coating material as claimed in Claim 2, wherein
14 adjacent columns are vertically staggered relative to
15 one another.

16

17 4. A coating material as claimed in Claim 2 or Claim
18 3, wherein the slots are dimensioned and arranged such
19 that the material can deform so as to expand and
20 contract in at least one direction to accommodate
21 thermal expansion and contraction of an underlying
22 elastomer coating to which the material is secured, in
23 use.

24

25 5. A coating material as claimed in any preceding
26 Claim, wherein said slots have six sides, having
27 generally V-shaped ends.

28

29 6. A coating material as claimed in Claim 5, wherein
30 the slots are arranged in vertically staggered columns,
31 the V-shaped ends of the slots of one column being
32 interleaved with the V-shaped ends of the slots of
33 adjacent columns.

34

35 7. A coating material as claimed in any preceding

1 Claim, wherein the material comprises an elongate strip
2 adapted to be helically wrapped about the length of a
3 tubular article.

4
5 8. A coating material as claimed in Claim 7, wherein
6 the elongate slots extend across the width of the
7 strip, allowing the strip to deform longitudinally with
8 expansion and contraction of the underlying elastomer
9 coating, in use.

10
11 9. A coating material as claimed in any preceding
12 Claim, wherein the slots occupy 50% or less of the
13 total surface area of the material.

14
15 10. A coating material as claimed in Claim 9, wherein
16 the slots occupy at least 25% of the total surface area
17 of the material.

18
19 11. A coating material as claimed in any preceding
20 Claim, wherein the sheet of anti-fouling material has a
21 thickness in the range 0.5 mm to 2 mm.

22
23 12. A coating material as claimed in any preceding
24 Claim, wherein the sheet of anti-fouling material has a
25 layer of elastomer material applied to one surface of
26 said sheet.

27
28 13. A coating material as claimed in Claim 12, wherein
29 said elastomer material has a thickness less than or
30 equal to that of the sheet of anti-fouling material.

31
32 14. A coating material as claimed in Claim 13, wherein
33 the thickness of said elastomer material is in the
34 range 0.5 mm to 1 mm.

35

1 15. A coating material as claimed in any preceding
2 Claim, wherein the length of the slots is in the range
3 3 mm to 50 mm.

4
5 16. A coating material as claimed in any preceding
6 Claim, wherein the width of the slots is in the range 1
7 mm to 6 mm.

8
9 17. A structure having an elastomer coating applied to
10 the surface thereof and a metallic anti-fouling coating
11 as claimed in any preceding Claim applied to the
12 surface of the anti-corrosion coating.

13
14 18. A structure as claimed in Claim 17, wherein said
15 structure is a tubular structure and said anti-fouling
16 material is in the form of an elongate strip helically
17 wrapped about and along the tubular structure.

18
19 19. A method of forming a structure as claimed in
20 Claim 17 or Claim 18, comprising the steps of applying
21 an elastomer coating to said structure, applying anti-
22 fouling material as claimed in any one of Claims 1 to
23 16 to said tubular member on top of said elastomer
24 coating so as to cover substantially all of the coated
25 surface of the structure, and processing the resulting
26 assembly to cure said elastomer coating and/or the
27 elastomer layer of said anti-fouling material (if
28 present) so as to bond said anti-fouling material to
29 said coating.

30
31 20. A method as claimed in Claim 19, wherein the
32 elastomer coating is uncured or at least partially
33 cured prior to application of the anti-fouling material
34 to the structure.

35

- 1 21. A method as claimed in Claim 19 or Claim 20,
2 wherein said anti-fouling material includes an
3 elastomer layer and wherein said elastomer layer is
4 uncured or partially cured prior to the application of
5 the anti-fouling material to the structure.
6
- 7 22. A method as claimed in Claim 19 or Claim 20 or
8 Claim 21, wherein a pressure strip is wrapped on top of
9 the anti-fouling material prior to final curing of the
10 assembly.
11
- 12 23. A method as claimed in Claim 22, wherein the anti-
13 fouling material does not include an elastomer layer
14 and wherein a strip of material, such as nylon, is
15 wrapped on top of the anti-fouling coating prior to the
16 application of said pressure strip, so as to inhibit
17 extrusion of elastomer through the slots in the anti-
18 fouling material.
19
- 20 24. A method as claimed in any one of Claims 19 to 23,
21 wherein the structure is a tubular structure and said
22 anti-fouling material is an elongate strip applied to
23 the structure by helically winding said strip about and
24 along the tubular structure.
25
- 26 25. A metallic, anti-fouling coating material,
27 substantially as hereinbefore described with reference
28 to the accompanying drawings.
29
- 30 26. A structure having an anti-fouling coating,
31 substantially as hereinbefore described with reference
32 to the accompanying drawings.
33
- 34 27. A method of forming a structure having an anti-
35 fouling coating, substantially as hereinbefore

- 1 described with reference to the accompanying drawings.
- 2
- 3



The
Patent
Office

14

Application No: GB 9605856.5
Claims searched: 1-27

Examiner: Alan Habbijam
Date of search: 23 May 1996

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): EIH (HCE) : B7A (AAEB) : F2P (P1A27, PC12, PC26, PC27, PC29)
: F4S.

Int Cl (Ed.6): B63B 59/00, 59/04 : E02B 17/00 : E02D 31/06 : F16L 58/00, 58/02,
58/04.

Other: Online:WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2221428 A (DAI-ICHI HIGH FREQUENCY CO) see plate 30 provided with elongate apertures 30a, Figs 14&15 in particular.	1
X	GB1576441 (USINES CHAUSSON) see eg Figs 2&9 and description at lines 18-28 on p4.	1,2&9 at least
X	GB686902 (USINES CHAUSSON) see Figs 1&2 and lines 120-130 on p2.	1-3&9 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.